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(54) **Tyre and wheel assemblies**

(57) In a tyre and wheel assembly the wheel rim tyre engagement zones each comprise a tyre bead retaining flange (5), a tyre bead seat (6) and an abutment region (8) which projects radially outwards of the bead seat (6), and the tyre beads each contain a substantially inextensible circumferentially extending bead reinforcement (2), and each have, when considered in radial cross-section in the inflated condition on the wheel rim, an effective size (11) measured in the inward radial direction of the assembly from the centre of the reinforcement (2) such that the tyre bead contacts the bead seat and is prevented from inward movement by the abutment (8) and a smaller effective size (10) measured from the centre of the annular reinforcement (2) in an axial, e.g. axially outward, direction, the smaller effective size (10) being less than the difference in radii between the annular reinforcement (2) and the radial extremity of the abutment (8) such that the tyre bead may, having been rotated so that the smaller effective size (10) extends radially, be passed over the abutment to its seat (6) for tyre fitting.

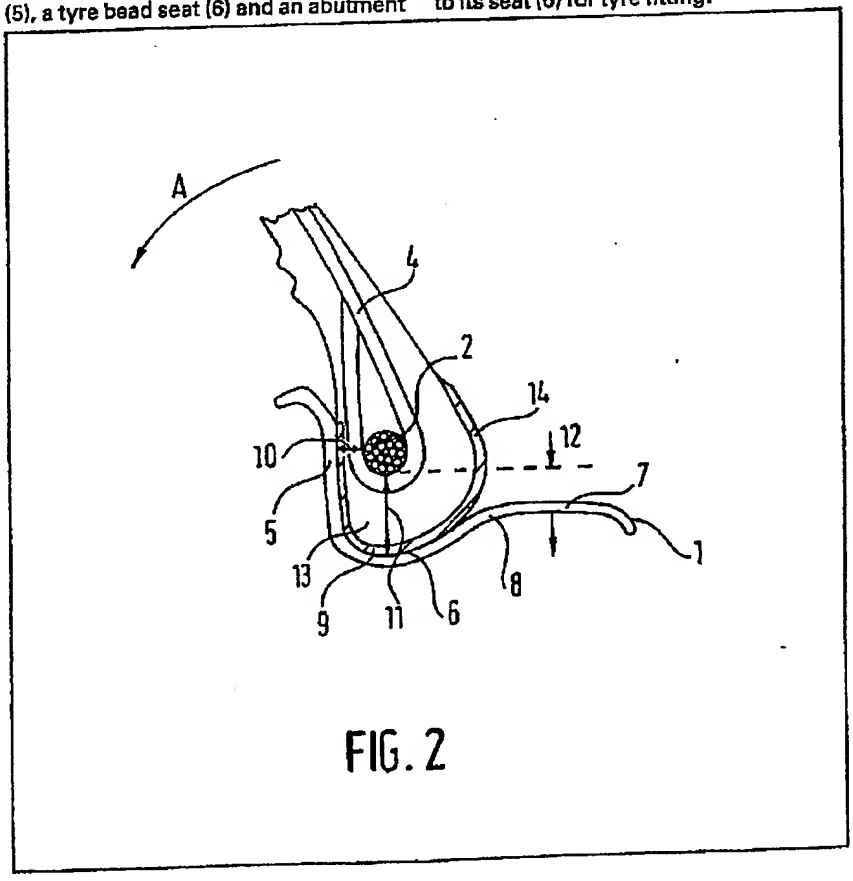

FIG. 2

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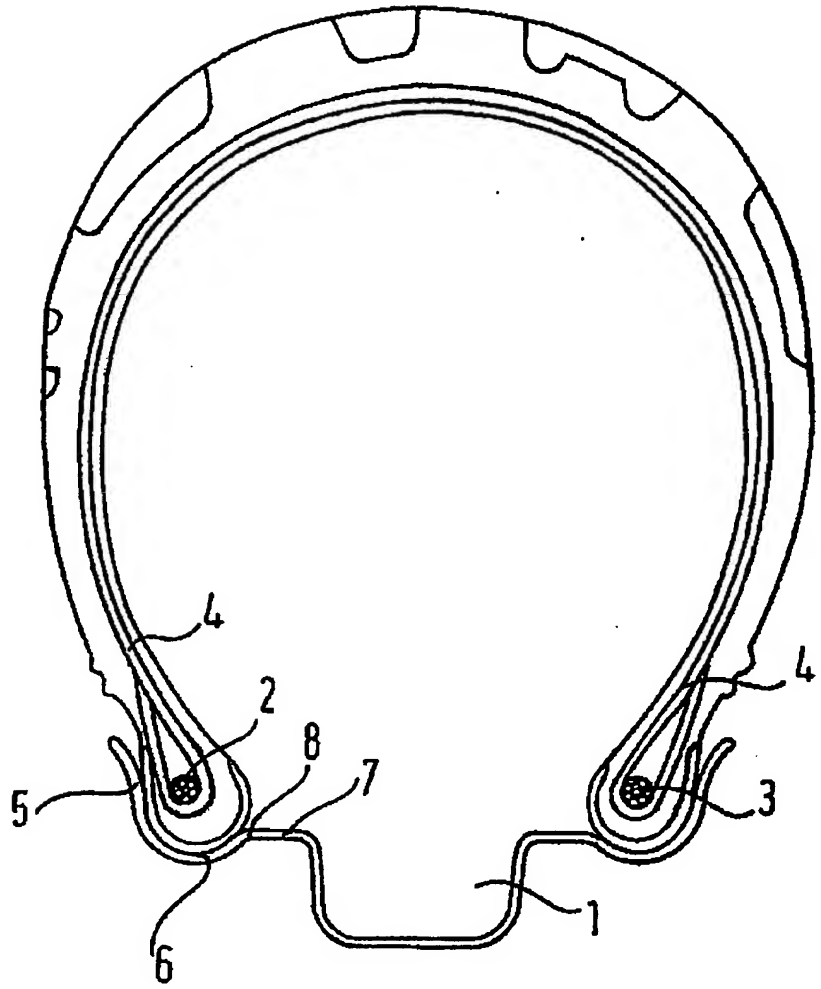

FIG.1

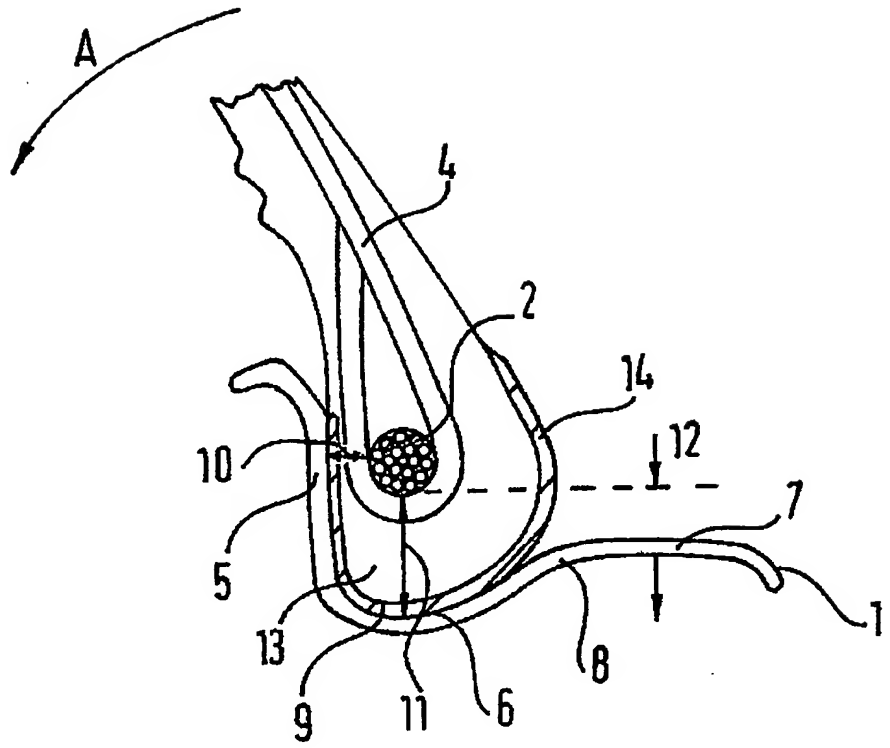

FIG. 2

SPECIFICATION

Improvements to tyre and wheel assemblies

This invention relates to tyre and wheel assemblies and in particular to pneumatic tyre and wheel rim assemblies.

In conventional tyre and wheel rim assemblies the tyre beads are retained on their bead seats by means of the internal air pressure.

Deflation of the tyre, however, leaves the tyre beads in a state whereby they may move inwardly from their bead seats under the influence of sideways force and this affects vehicle control and safety.

It is an object of the present invention to provide a tyre and wheel rim assembly in which the tyre beads are retained in position regardless of air pressure in the tyre.

According to one aspect of the present invention a tyre and wheel rim assembled in which the wheel rim comprises a pair of spaced apart tyre engagement zones each comprising an axially outer tyre bead retaining flange, a tyre bead seat and immediately adjacent the bead seat an abutment region which projects radially outwards of the bead seat and the tyre comprises a pair of beads each containing a substantially inextensible circumferentially extending bead reinforcement and each of the beads, when considered in radial cross-section in the inflated condition on the wheel rim having an effective size measured in the inward radial direction of the assembly from the centre of the reinforcement such that the tyre bead contacts the bead seat and is prevented from inward movement by the abutment and a smaller effective size measured from the centre of the annular reinforcement in the axial direction of the assembly, the smaller effective size being less than the difference in radius between the annular reinforcement and the axial extremity of the abutment such that the tyre bead may, having been rotated so that the small effective diameter extends radially, be passed outwardly over the abutment to its seat for tyre fitting.

The smaller effective size may be provided extending to the axially inner tyre bead surface but preferably it extends to the axially outer tyre bead surface.

Preferably the larger effective size is 1.2 or more times larger than the smaller effective size.

The tyre bead is preferably formed in the regions of the larger effective size of material having a hardness between 40 and 96° Shore A and more preferably in the range 60-96° Shore A. Furthermore a fabric reinforcement ply may be provided adjacent to the bead periphery.

The bead seat region of the tyre bead is preferably convex towards the bead seat and the bead seat is a complementary concave shape such that in the normal inflated condition the tyre bead rests in the concave seat and is prevented from axially outward and inward movement by the wheel rim flange and abutment respectively.

Another aspect of the present invention provides a tyre for a tyre and wheel rim assembly of the type set out comprising a tread, a pair of sidewalls and a pair of tyre beads each containing a substantially inextensible circumferentially extending annular reinforcement and each of the beads when considered with the tyre on the radial cross-section taken up when fitted to a wheel rim and inflated having an effective size in the bead periphery measured in the inward radial direction of the tyre from the centre of the annular reinforcement which is substantially greater than the effective size measured from the centre of the annular reinforcement to the bead periphery in the axial direction of the tyre.

Preferably the larger effective size is 1.2 or more times larger than the smaller effective size.

Preferably the smaller effective size is in the axially outer region of each tyre bead although it may be in the axially inner region. The tyre bead in the region of the greater effective size may be of rubber compound having a hardness of 40-96° Shore A or more preferably 60-96° Shore A. Furthermore the bead region may be reinforced by a reinforcement ply provided adjacent the periphery of the bead which ply may be a woven or non-woven metal or textile fabric.

The tyre may be of the cross-ply, belted bias, radial or fabricless type. The wheel rim may be of various types but is preferably of the type including a well to allow tyre fitting.

Yet another aspect of the invention provides a method of fitting a tyre to a wheel rim both according to the present invention comprising placing both tyre beads in a wheel rim well in the conventional manner, applying force to the tyre sidewall so that the bead is rotated so that its small effective size lies in the radially inward direction, moving said bead axially outwards over the abutment to its bead seat, and rotating the bead so that its larger effective size extends radially inwards to engage the bead seat and repeating the operation to fit the other bead to its seat.

The method may be modified to rotate and fit both tyre beads simultaneously.

Further aspects of the present invention will be apparent from the following description, by way of example only, of one embodiment in conjunction with the attached diagrammatic drawings in which:-

Figure 1 is a cross-section of a tyre and wheel rim according to the present invention;

Figure 2 is an engaged cross-section of the tyre bead and wheel rim flange and bead seat area of the assembly shown in Figure 1.

The assembly shown in Figure 1 is a 2¼ - 17 light weight motor cycle tyre fitted to a 1.65 inch wheel rim having a central fitting well 1.

The tyre comprises a pair of circumferentially continuous bead hoops 2 and 3 around each of which are anchored the edges of carcass reinforcement plies 4. The tyre sidewalls and tread region are all of normal construction but the tyre beads and wheel rim bead seats are each as shown in greater detail in Figure 2.

The bead seating region of the wheel rim comprises an outer flange 5 which extends in a generally radial direction in conventional manner, a bead seat 6 which is concave as shown and an inner region 7 of

greater radius than the bead seat 6 so that it forms an abutment 8 at the axially inner edge of the concave bead seat 6. The inner region 7 extends to the edge of the fitting well 1 as shown.

The tyre bead has the bead hoop 2 positioned nearer one side than its bead base 9. The dimension 10 from the bead hoop 2, which is a conventional multi-wire ring, measured in the axial direction of the assembly is thus small compared with the dimension 11 from the bead hoop in the radial direction of the assembly to the bead base 9. The dimensions are chosen so that the small dimension 10 is less than the dimension 12 which is the difference in radius between the radially inner extremity of the bead hoop 2 and the radially outer extremity of the diameter of the abutment 8. The large dimension 11 is substantially greater than the smaller dimension 10 and also is substantially larger than the dimension 12 so that when the bead is in the fitted position so that it cannot move axially inwards, i.e. to the right in Figure 2, due to the difference in diameters of the bead base 9 and the abutment 8.

The dimension 11 is greater than the dimension 12 and the region 13 of the bead beneath the bead hoop 2 is formed by rubber having a hardness of greater than 60° Shore A. The bead region is also wrapped by an outer ply reinforcement 14 which is a cross-woven tyre fabric and which acts as a reinforcement skin to maintain the bead shape and in particular the dimension sizes 10 and 11. Alternative fabrics may be used for ply reinforcement including weftless material.

It should be understood that the dimensions or distances referred to are not strictly speaking the actual distances but the "effective" distances by which is meant the geometrical size with an allowance for the compression stiffness of the material forming the bead. Thus the dimension 11 must always be greater than the dimension 12 even when the applied loads radially between the bead base 9 and the bead hoop 2 act to compress the bead along the dimension 11.

The tyre bead is fitted to the wheel rim by fitting it into the well 1 in the usual manner, applying a tool to the type to rotate the bead about the centreline of the bead by about 90° in the direction A so that the dimension 10 is in the radial direction which dimension 10 is less than dimension 12, moving the bead axially outwards to the flange 5 and rotating the bead so that the bead engages its seat as shown in the Figures. Tyre removal is effected by rotating the beads and then displacing them to the well.

The tyre described above is a motorcycle tubeless tyre but the invention is applicable to any known type of tyre having annular bead reinforcements of the tubed or tubeless type and independent of the vehicle type.

CLAIMS

1. A tyre and wheel rim assembly wherein the wheel rim comprises a pair of spaced apart tyre engagement zones each comprising an axially outer tyre bead retaining flange, a tyre bead seat and immediately adjacent the bead seat an abutment region which projects radially outwards of the bead seat and the tyre comprises a pair of beads each containing a substantially inextensible circumferentially extending bead reinforcement and each of the beads, when considered in radial cross-section in the inflated condition on the wheel rim having an effective size measured in the inward radial direction of the assembly from the centre of the reinforcement such that the tyre bead contacts the bead seat and is prevented from inward movement by the abutment and a smaller effective size measured from the centre of the annular reinforcement in the axial direction of the assembly, the smaller effective size being less than the difference in radii between the annular reinforcement and the axial extremity of the abutment such that the tyre bead may, having been rotated so that the small effective diameter extends radially, be passed outwardly over the abutment to its seat for tyre fitting.

2. A tyre and wheel rim assembly according to claim 1 wherein the larger effective size is at least 1.2 times the smaller effective size.

3. A tyre and wheel rim assembly according to claim 1 or 2 wherein the smaller effective size extends in the axial directon outwards of the tyre bead to the axially outer tyre bead surface.

4. A tyre and wheel rim assembly according to claim 1 or 2 wherein the smaller effective size extends in the axial direction inwards of the tyre bead to the axially inward tyre bead surface.

5. A tyre and wheel rim assembly according to any one of claims 1-4 wherein the tyre bead in the region of the larger effective size is formed by material having a hardness between 40 and 96° Shore A.

6. A tyre and wheel rim assembly according to any one of claims 1-4 wherein the tyre bead in the region of the larger effective size is formed by material having a hardness between 60 and 96° Shore A.

7. A tyre and wheel rim assembly according to any one of claims 1-6 wherein a fabric reinforcement ply is provided adjacent to the periphery of the bead and extends around the portion of the bead in contact with the bead seat.

8. A tyre and wheel rim assembly according to any one of claims 1-7 wherein the bead seat region of the tyre bead is convex towards the bead seat and the bead seat is a complementary concave shape such that in the normal inflated condition the tyre bead rests in the concave seat and is prevented from axially outward and inward movement by the wheel rim flange and abutment respectively.

9. A tyre and wheel rim assembly according to any one of claims 1-8 wherein the wheel rim includes a well for tyre fitting.

10. A tyre for a tyre and wheel rim assembly of the type set out comprising a tread, a pair of sidewalls and a pair of tyre beads each containing a substantially inextensible circumferentially extending annular reinforcement and each of the beads when considered with the tyre on the radial cross-section taken up when fitted to a wheel rim and inflated having an effective size in the bead

periphery measured in the inward radial direction of the tyre from the centre of the annular reinforcement which is substantially greater than the effective size measured from the centre of the annular reinforcement to the bead periphery in the axial direction of the tyre.

11. A tyre according to claim 10 wherein the larger effective size is at least 1.2 times the smaller effective size.

12. A tyre according to claim 10 or 11 wherein the smaller effective size extends in the axial direction outwards of the tyre bead to the axially outer tyre bead surface.

13. A tyre according to claim 10 or 11 wherein the smaller effective size extends in the axial direction inwards of the tyre bead to the axially tyre bead surface.

14. A tyre according to any one of claims 10-13 wherein the tyre bead in the region of the larger effective size is formed by material having a hardness between 40 and 96° Shore A.

15. A tyre according to any one of claims 10-13 wherein the tyre bead in the region of the larger effective size is formed by material having a hardness between 60 and 96° Shore A.

16. A tyre according to any one of claims 10-15 wherein a fabric reinforcement ply is provided adjacent to the periphery of the bead and extends around the portion of the bead in contact with the bead seat.

17. A tyre according to any one of claims 10-16 wherein the bead seat region of the tyre bead is convex in the radially inward direction.

18. A tyre according to any one of claims 10-17 wherein the tyre is a radial ply tyre.

19. A method of fitting a tyre to a wheel rim both according to the present invention comprising placing both tyre beads in a wheel rim well in the conventional manner, applying force to the tyre sidewall so that the bead is rotated so that its small effective size lies in the radially inward direction, moving said bead axially outwards over the abutment to its bead seat, and rotating the bead so that its larger effective size extends radially inwards to engage the bead seat and repeating the operation to fit the other bead to its seat.

20. A method as in claim 19 wherein both beads are rotated and fitted simultaneously.

21. A tyre and wheel rim assembly constructed and arranged substantially as described herein and illustrated in Figures 1 and 2 of the accompanying drawings.

22. A tyre constructed and arranged substantially as described herein and illustrated in Figures 1 and 2 of the accompanying drawings.

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